DEPARTMENT OF NATURAL RESOURCES
WATER PROTECTION PROGRAM
WATER QUALITY MONITORING AND ASSESSMENT SECTION
WATERSHED INFORMATION SHEET

North River
Basin-07110004

Basin Description

The North River basin lies in northeastern and eastern Missouri and encompasses the watersheds of the North and South Rivers and several small direct tributaries to the Mississippi River in Pike and Lincoln counties. North River originates in Knox County near Novelty and flows eastward into the Mississippi River. Aside from North River, the larger streams in this basin include South River, Noix, Buffalo, Bryant and Bob's creeks, all of which flow directly into the Mississippi River. The basin also contains the Old Kings Lake slough, with 22 miles of standing or slowly flowing waters in the Mississippi River floodplain in Lincoln County. The basin is 1,018 square miles in area. The largest reservoir in the basin is Hunnewell Lake with a surface area of 228 acres. There are two small public drinking water reservoirs in this basin that serve the town of Bowling Green.

Average annual rainfall is 39 inches. Stream flow statistics for the basin are shown in Table 1.

Table 1. Stream Flow Statistics for the North River Basin

Stream/Location	Watershed Area (sq.mi.)	Period Of Record	Flow (cfs)				
			90th Percentile *	Mean	Median **	10th Percentile ***	7Q10 Low Flow+
North R. @ Palmyra	263	1934-2004	454	260	38	3.4	0.0
Bear Cr. nr Hannibal		1938-42 1947-2004	51	23.2	4.5	0.60	0.0

*Flow is less than this amount 90 percent of the time
**Flow is less than this amount 50 percent of the time
***Flow is less than this amount 10 percent of the time
+ The lowest average seven consecutive day flow that occurs with a recurrence interval of 10 years.
++ Record exists for most years in this interval

The North River basin lies within the Dissected Till Plains physiographic province and is characterized by a mixture of hills and open plains. Basin-wide, 38 percent of the land is row crop, 37 percent is pasture and hay fields, 22 percent forest and 1 percent open water.

Except for areas in the lower portions of the basin where streams have incised Mississippian aged rock, the surface of the basin is glacial till overlain by loess. Glacial till is a mostly unsorted mixture of clay, sand, gravel and rock debris created and pushed southward into Missouri by the great glacial ice sheets. Loess is a windblown silt deposit.

Depth of the till is highly variable but is generally less than 200 feet. Loess deposits are less than 4 feet in depth.

The presence of the clayey till and the underlying shale beds ensure that there is very little movement of water to the subsurface. Most water movement in the basin is through the surface stream network. Water that reaches the subsurface will resurface locally when a stream valley incises a confining aquatard (an impermeable layer). Since very little water infiltrates to the subsurface, streamflow can be very high during wet weather. For the same reason, base flows, streamflow sustained only by the re-emergence of groundwater into the stream, are very low during the intervening dry periods. There are 34 small springs of note in the basin. None of these sustain flow in dry weather.

Water Quality Concerns

Acceptable water quality is defined by Missouri's Water Quality Standards [http://www.sos.mo.gov/adrules/csr/current/10csr/10c20-7a.pdf] . Streams or lakes that do not meet these standards are considered "impaired." They may not be fit for certain uses such as swimming, drinking water supply or protection of fish and other aquatic life. Waters are considered "affected" rather than "impaired" if water quality changes are less serious and state standards are not exceeded. These standards also list more than 3,600 classified streams and more than 400 classified lakes in the state. A classified stream is one that is either a permanently flowing stream or one that may stop flowing in dry weather but still maintains large pools of water that support aquatic life. Unclassified streams are small tributaries to classified streams. They typically have flowing water only during wet weather and are dry for the remainder of the year.

Water Quality in Prairie Streams
http://www.dnr.mo.gov/env/wpp/watersheds/info/wq-prairie-str.pdf

Aquatic Habitat in Prairie Streams
http://www.dnr.mo.gov/env/wpp/watersheds/info/aquatic-hab-prairie-str.pdf

Point Source Pollution

Point source pollution is a discharge of wastewater from a single location such as a wastewater treatment plant. Wastewater treatment plants can serve industries, small businesses, subdivisions, mobile home parks, apartment complexes, or entire cities. Wastewater from residential sources such as subdivisions, apartments and mobile home parks is often referred to as "domestic wastewater." It primarily contains treated human wastes, food wastes and detergents. The primary pollutants of concern in domestic wastewater are the amount of organic matter, which is commonly reported as Biological Oxygen Demand (BOD), suspended solids, and ammonia. Industrial and commercial wastewater can be more complex and may contain, in addition to domestic wastes, heavy metals or man-made organic chemicals that can be potentially toxic. Discharges from most municipal wastewater treatment plants are usually a mixture of domestic and

industrial/commercial wastewater. Most wastewater plant discharges are also typically high in nitrogen and phosphorus, two elements that act as fertilizers and can cause excessive algae growth in waters receiving these discharges.

There are 45 permitted domestic or industrial/commercial point sources that discharge a combined 10.54 million gallons per day (mgd) of treated wastewater into the waters of the North River basin. There are 237.5 miles of classified streams in the basin, only one mile of which (less than one percent) is known to be affected or impaired by point source wastewater discharges. There are 3.9 miles of unclassified streams affected or impaired by point source wastewater discharges. Wastewater discharges that affect at least 0.5 miles of their receiving streams include municipal discharges from Hannibal, Elsberry, Monroe City and Winfield.

Wastewater Treatment
http://www.dnr.mo.gov/env/wpp/watersheds/info/wastewater-treatment.pdf

Nonpoint Source Pollution

Nonpoint source pollution occurs when pollutants enter bodies of water at points that are not well-defined and stable. Examples include the erosion of sediments or the entrance of polluted surface runoff or groundwater into lakes and streams. Locations of nonpoint source pollution are often widely dispersed and are difficult to identify or control. In the North River basin, the most serious nonpoint problem is degradation of aquatic habitat. A total of 86.5 miles (36 percent) of classified streams in the basin are considered to have degraded aquatic habitat. The lack of infiltration of rainfall, when combined with local soil tillage and other land uses leads to a large amount of surface runoff during wet weather. This contributes to soil erosion and high levels of sediment deposition in streams. The quality of aquatic habitat is further impaired by removal of wooded riparian vegetation, and by the channelization, or straightening, of streams. Channelization has occurred in 15 miles (6 percent) of streams in the basin.

Storm water runoff in the Midwest can also carry significant amounts of fertilizers, animal wastes, and pesticides into streams.

During warm weather when stream flows are low, livestock tend to gather in and around streams. The wastes they leave behind in the water contributes to nuisance algae growths, low levels of dissolved oxygen and elevated levels of ammonia and bacteria.

Many private residences use groundwater as a drinking water supply. Studies of private well water quality in northeastern Missouri have shown that about 20 percent of all private wells sampled exceeded drinking water standards for nitrate. Up to 2 percent of wells exceeded drinking water standards or health advisory levels for pesticides, most commonly the herbicides Atrazine or Alachlor. This contamination is often caused by local land use practices or surface contamination of the wellhead and does not represent widespread contamination of the underground aquifer. Deeper aquifers are protected from surface contamination by impermeable strata.

Water Quality Management

The department achieves water quality management of point source pollutants through the issuance and enforcement of wastewater discharge permits. These permits limit the amount of pollutants that can be discharged. All point source wastewater dischargers must obtain a permit and adhere to its discharge limitations. All permits require at least a level of treatment equal to national wastewater treatment standards. In situations where these national treatment standards are not adequate to protect the streams or lakes receiving these wastewater discharges, stricter permit limits that do protect these waters are required. The permits require regular monitoring and reporting of discharge quality. The department also conducts regular inspection of wastewater treatment facilities and receiving waters.

Nonpoint source pollution is addressed through the state's nonpoint source management plan. This plan is a cooperative program between the Department of Natural Resources and other federal, state and local government agencies or organizations, local landowners and other interested citizens. The plan emphasizes addressing problems at the watershed level through the use of management practices that control nonpoint pollution. The most commonly supported practices are those that control soil erosion on agricultural and urban lands, improve quality and quantity of forage on grazing lands, protect riparian zones, and those that control runoff of animal manure, fertilizers and pesticides. The state nonpoint source management plan is a voluntary program that provides funds to help defray the cost of adopting management practices.

Since 1990, there have been four nonpoint source watershed projects in the basin. These projects have been funded by state sales tax money earmarked for soil and water conservation. These projects treated more than 8,300 acres of land, comprising about 1 percent of the entire basin.

Table 3. Nonpoint Source Watershed Projects in the North River Basin.

Watershed Name	County	Project Date	Watershed Size (Acres)	Acres Treated	Percent of Watershed Treated
Big Branch	Marion	1994-98	6,790	2,382	35%
Hawkins Branch	Marion	1994-98	6,175	2,310	37%
Bear Cr.	Marion	1995-99	9,160	1,893	21%
Lick Cr.	Marion	1995-99	6,500	1,759	27%

The Missouri Department of Natural Resources monitors water chemistry and aquatic invertebrate communities at many locations in Missouri. The department also tracks the quality of domestic, industrial and storm water discharges. These monitoring activities provide information on water quality problems, such as their specific location, pollutants, sources and possible solutions. This information guides the management activities the department takes to protect water quality in Missouri.

Web links

US Geological Survey
http://mo.water.usgs.gov/

Kansas City District Corps of Engineers
http://www.mvs.usace.army.mil/

Missouri Department of Conservation
http://www.mdc.mo.gov/fish/watershed/north/contents/290cotxt.htm

US Environmental Protection Agency
http://www.epa.gov/region7/water/index.htm